NC-137

United States Department of Agriculture

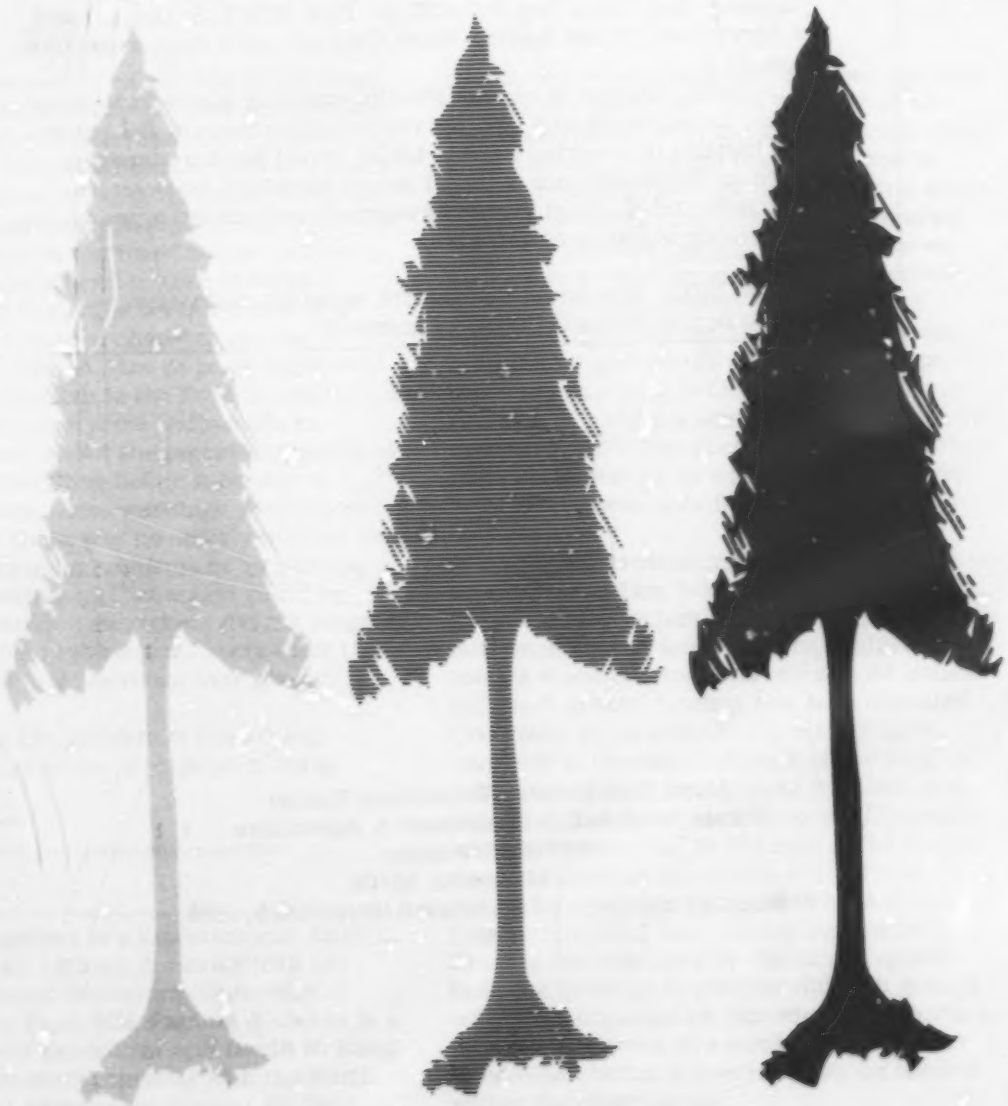
Forest Service

North Central Forest Experiment Station

General Technical Report NC-137

Identifying Emerging Issues in Forestry as a Tool for Research Planning

Hans M. Gregersen, Allan L. Lundgren, Pamela J. Jakes and David N. Bengston



A13.88:

READEX best copy available

Gregersen, Hans M.; Lundgren, Allen L.; Jakes, Pamela J.; Bengston, David N.

1989. Identifying emerging issues in forestry as a tool for research planning. Gen. Tech. Rep. NC-137. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 21 p.

A Delphi exercise is used to identify emerging issues in National Forest management and use, the relative importance of the issues, and barriers to resolving issues. USDA Forest Service managers agree on the importance of the 11 issues identified; however, researchers and National Forest managers do not always agree on the importance of issues or barriers.

KEY WORDS: Research management, research evaluation, research needs, National Forest management.

North Central Forest Experiment Station
Forest Service--U.S. Department of Agriculture
1992 Folwell Avenue
St. Paul, Minnesota 55108
Manuscript approved for publication November 9, 1989
1989

IDENTIFYING EMERGING ISSUES IN FORESTRY AS A TOOL FOR RESEARCH PLANNING

Hans M. Gregersen, Allen L. Lundgren, Pamela J. Jakes, and David N. Bengston

As with all research, it takes time for forestry research to produce results. New research initiatives can seldom offer immediate answers to the emerging critical problems faced by clients. The process by which clients, researchers, and research managers identify problems or emerging issues must be improved so that research solutions can be offered in time to make a difference—by finding either a solution to a problem or a means of changing course to avoid the problem. A case-in-point is the acid precipitation problem in the Federal Republic of Germany. Although some individuals expressed concern about the potential impacts of acid precipitation long before it became a serious problem, these warnings went unnoticed because there was no orderly process for identifying emerging problems or for alerting research managers so that action could be taken. As a result, researchers did not respond seriously to this problem until more than 15 years after the first warnings were given.[1]

Compounding the problem of identifying emerging issues is the perception of many clients that researchers set their own agendas and are not concerned with whether or not such agendas address the key problems clients face. Indeed, a concern that USDA Forest Service research does not have a central focus, and that scientists are free agents operating outside a planned research agenda, was expressed in a recent report on Forest Service research competitiveness (Chapman and Milliken 1988). We need to explore whether researchers and clients agree about the priority problems emerging in forestry. Differing perceptions of priorities would indicate a need for expanded communication between researchers and clients and for development of improved tools for consensus building.

In some cases researchers and clients agree on research priorities, but external events direct the research program. To survive, researchers may need to shift long-standing problem-solving research programs to focus on issues for which special funding has been allocated. One could argue that the Forest Service's response to the establishment of the National Acid Precipitation Assessment Program caused this type of shift in research focus (Chapman and Milliken 1988). In the case of the Forest Service, where major clients (the National Forest System and State and Private Forestry), researchers, and those allocating research funding are employed by the same organization, the question is whether different groups within the organization perceive the importance of emerging issues in a similar way. If perceptions differ, better interaction may be needed within the organization.

[1] *R. Plochmann, personal communication.*

Hans M. Gregersen is a Professor and **Allen L. Lundgren** is an Adjunct Professor with the College of Natural Resources, University of Minnesota, St. Paul, MN. **Pamela J. Jakes** is a Principal Forest Economist and **David N. Bengston** is a Resource Economist with the North Central Forest Experiment Station, St. Paul, MN.

We conducted a study of emerging issues in forestry and barriers to addressing the issues. In this paper we provide empirical evidence on the degree of consistency between perceptions of emerging issues held by field managers and those held by researchers. We also provide information on the extent to which the views of different groups differ on barriers to resolving emerging issues. Obtaining information on emerging issues is a first step in improving communication between those who use research and those who do research.

OBJECTIVES

The objectives of the study were to (1) develop a procedure for identifying emerging issues in forestry, and (2) conduct a case study applying the procedure to an actual situation. Our goal is to facilitate development of forestry research programs by developing a procedure for identifying emerging forestry issues.

In our case study, we applied the procedure we developed to the task of identifying emerging issues in National Forest management and use. We demonstrate here how hypotheses about differences in responses between respondent groups, geographic regions, and job tenure can be tested.

METHOD

The Delphi Method

A modified Delphi approach was used for achieving the study objectives. The basic Delphi "...is a group of procedures for eliciting and refining the opinions of a group of people" (Weatherman and Swenson 1974). Linstone and Turoff (1975) focus on the Delphi as "structured communication" that allows a group of individuals to deal with a complex problem. They identify seven situations or types of problems to which the Delphi is most applicable, several of which are common to natural resource management and use, including:

- problems that do not lend themselves to precise analytical techniques;
- broad or complex problems that require contributions by individuals having no history of adequate communication;
- issues where disagreements among individuals are so severe or politically unpalatable that standard communication processes are ineffective and/or anonymity of participants must be assured.

The most common Delphi process (and the one applied here) is called the Delphi exercise. In a Delphi exercise, a small team designs a questionnaire, which is sent to a respondent group. The questionnaire is returned, and the team summarizes the results. Using these results, the team designs a new questionnaire. In the second questionnaire, respondents to the first questionnaire are asked to consider the results, to change or re-evaluate their first response, and to provide further input to help focus the results. Additional rounds of questionnaires may be used until some desired level of consensus is achieved or no further consensus is thought possible.

The technique was originally developed in the 1950's at the Rand Corporation for use in studying opinions related to defense issues (Helmer 1967). Since then, many studies have used the basic approach, usually modified to fit specific study needs. Most of the modifications retain the characteristics of the Delphi exercise described above.

Variations on the basic Delphi technique also have been used quite widely in natural resource fields. For example, Shafer *et al.* (1974) used the technique to provide direction for formulating policies to deal with future environmental problems. Baughman and Ellefson (1983) used the technique to study options for county forest land in Minnesota. Schuster *et al.* (1985) applied a Delphi to a study of elk habitat quality. The technique also has been used in other countries. For example, Gunderman (1978) used a Delphi to look at standards and criteria for forest roads in the Federal Republic of Germany. Phillips *et al.* (1986)

looked at forest economics research needs for west-central Canada by using a Delphi technique for part of the study.

Study Participants

Because the objective of our case study was to identify issues relating to National Forest management and use, we surveyed all Forest Service Regional Foresters and Forest Supervisors, and a random sample of District Rangers (at least one per forest). We identified 60 organizations and corporations that use National Forest outputs (timber, recreation visitor days, animal unit months of grazing, acre feet of water) and included them in our study. Because the goal of identifying emerging issues is to develop timely research programs, we also sent the Delphi questionnaire to a group of researchers. Due to budget and time constraints, we included only forest economics researchers, from the Forest Service and various universities. Figure 1 indicates the numbers of individuals contacted initially in each respondent group, and the numbers participating in each stage of the study.

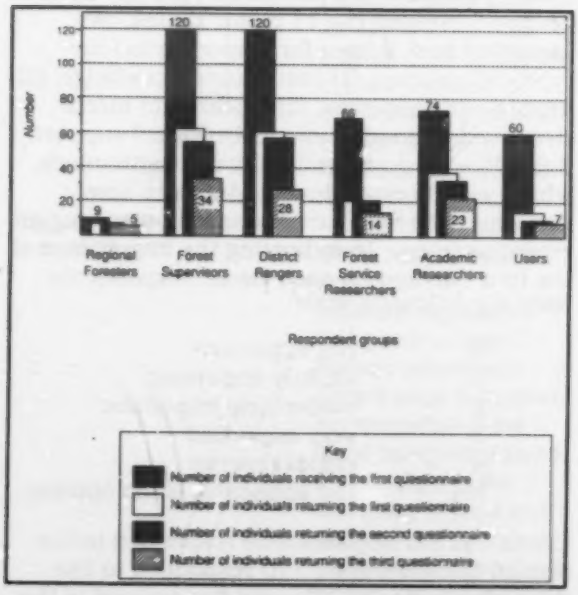


Figure 1.–*Number of respondents in each stage of the Delphi exercise by respondent groups.*

The Delphi Exercise—Identifying Emerging Issues and Barriers

First, we mailed an open-ended questionnaire that asked the following question:

> "From your point of view, what are the most important emerging forestry issues that National Forest managers (Rangers, Forest Supervisors, Regional Foresters) and National Forest users will face over the next 10-15 years?".

If the participant was a National Forest line manager, that person's title was entered in place of "National Forest managers (Rangers, Forest Supervisors, Regional Foresters)"—i.e. "District Rangers," "Forest Supervisors," "Regional Foresters."

Although we are ultimately concerned with developing timely research programs to address emerging issues, we did not directly ask individuals to identify research issues or needs. We were concerned that when an individual is asked to identify his or her research needs, the person is predisposed to respond in a certain way—with technical research topics dealing with genetics, forest management, forest utilization, etc. Because we were trying to identify **emerging** issues for research, we wanted to break away from the traditional responses. So, we decided to concentrate on identifying problems the individual faces in his or her job, and then leave it to the researchers and research managers to decide how research could contribute to the discussion and resolution of the issue.

Of the original 449 individuals contacted, 204 responded to the first questionnaire. The study team collated, analyzed, and synthesized these responses. Eleven major issue areas emerged from our analysis (table 1).

A second questionnaire was then prepared and mailed to all respondents. The goal of the second questionnaire was to obtain respondents' views on the relative importance of the

Table 1.—Emerging issues in National Forest management and use[1]

Increasing conflicts and polarization among various National Forest users (recreationists, hunters, loggers, etc.). [Conflicts among user groups]
Increasing conflicts between local and national interests and priorities. [Conflicts between local and national interests]
Increasing adverse impacts on the National Forests due to certain uses (e.g., off-road vehicles, marijuana growing). [Adverse impacts due to certain uses]
Increasing problems associated with the wildland/residential/urban interface. [Wildland/residential/urban interface]
Increasing role of the National Forests in watershed and water management. [Watershed and water management]
User fees becoming commensurate with costs (e.g., below cost timber sales, recreation). [User fees commensurate with costs]
Declining resources to manage the National Forests. [Declining resources]
Effectiveness and cost of forest planning process. [Forest planning process]
Inconsistencies between priorities established in the planning process and those in the budgeting/appropriations process. [Inconsistencies in priorities established during the planning and budgeting processes]
Increased use of legal and political processes to challenge decisions and forest plans. [Legal and political challenges to decisions]
Increasing constraints on planning and management activities due to environmental/conservation concerns expressed in laws or regulations (e.g., threatened and endangered species, herbicides). [Constraints imposed by laws or regulations]

[1]Phrases in brackets indicate how issues are referenced in tables and figures.

11 major issue areas, and to have them indicate any critical issues we missed in our synthesis. We asked respondents to use a technique called magnitude scaling to indicate relative importance. Respondents assigned a number value to each issue indicating its importance relative to a reference issue, to which we arbitrarily assigned a value of 80. The participants could use any scale they wished, from 1 to 10,000 or from -100 to +100; the only stipulation was that the number given an issue indicate the importance of that issue relative to the reference issue. Two questionnaires were developed, differing in issue order and the reference issue.

Of the 204 individuals responding to the first questionnaire, 182 responded to the second questionnaire. From the responses to the second questionnaire, we were able to determine the relative importance of the 11 issues and test if there were differences in relative importance based on issue ordering on the questionnaire, respondent groups, tenure, and region.

Finally, we wanted to determine the key barriers to addressing the 11 major issues. We identified and defined for respondents four types of barriers: (1) inadequate knowledge, (2) inadequate resources, (3) inadequate incentives, and (4) inadequate institutional support (table 2). We developed a third questionnaire, which asked respondents to indicate how important the four barriers were to resolving an emerging issue. In indicating the importance of the four barriers for each issue, respondents used the following scale:

0	not important
1	slightly important
2	moderately important
3	very important
4	critical barrier
NA	not applicable or no opinion

Of the 182 participants who responded to the second questionnaire, 110 responded to the third questionnaire. Twenty-five percent of the individuals who received the first questionnaire participated in all three stages of the survey.

Table 2.—*Definitions of barriers provided to respondents on the third questionnaire*

Barrier	Definition
Inadequate knowledge	Refers to the adequacy of technical information to deal with the issues; also related to the adequacy of our *understanding* of the economic, legal, and other elements involved in resolving the issues.
Inadequate resources	Relates to the adequacy of the budget of human resources in terms of applying known means of resolving the issues.
Inadequate incentives	Relates to the extent to which Forest Service management policies, including promotion policies and "perks," encourage action to resolve the issue; also relates to the adequacy of the incentives for user interest groups to support effective resolution of the issue.
Inadequate institutional support	Refers to the adequacy of the body of national and local laws and regulations that govern Forest Service activity and organization in supporting resolution of the issue being considered; it also refers to the adequacy of local and national citizen organizations that interact with Forest Service management; it refers in general to the adequacy of institutional channels for resolving issues.

Limitations and Considerations for Analysis

Our goal in this study was to identify emerging issues by collecting ideas from those in the profession who think about issues and feel it is important to express their opinions when given an opportunity. Thus, we were not concerned with obtaining a representative sample from each respondent group nor are we concerned about our low response rate. Those who did respond seemed eager to express their views, and many indicated that they had been thinking about the question posed in the first questionnaire for some time. These were exactly the individuals we wanted in our panel. In a sense, a Delphi study builds in an intentional sample selectivity bias in an attempt to get at issues.

Other Delphi studies have obtained higher response rates by contacting and obtaining a commitment from potential participants before the first questionnaire. To help guarantee that we reach all interested participants, we contacted the entire population of Regional Foresters and Forest Supervisors, an unbiased sample of District Rangers, and all the researchers we could identify.

Because we were not dealing with a statistical sample, we cannot offer statistically based inferences on how the entire population of District Rangers, etc., views the issues. Rather, we were dealing with our defined population of experts, and the statements made and interpretations presented relate only to that group. The study results provide indications of emerging issues based on the opinions of a large group of people actively involved with forest management and forestry research.

In the process of consolidating and organizing the many issues raised in the first open-ended questionnaire, we risked introducing our biases or missing an important issue. We minimized this danger by stressing in the second questionnaire that respondents should write in any issues we had missed. Several additional issues were received, but none were mentioned by more than two people, and some were rewordings of one of the 11 issues. However, we

have reproduced a list of these issues in Appendix A. These additional issues should not be lost because it is often the one "voice in the wilderness" that portends the critical issue of the next decade.

RESULTS

With the above points in mind, we discuss the questionnaire results. First, we look at results related to issues. Second, we look at results related to barriers to resolving the issues.

Results Related to Issues

Issue Definition

In the first questionnaire, respondents were asked to indicate the "most important emerging forestry issues" related to National Forest management and use. Participants responded with phrases, sentences, and paragraphs. From the hundreds of pages of text, 11 issues surfaced that summarized most of the concerns raised. Phrases used below to define these issues come directly from responses to the first questionnaire. These definitions were included in the second questionnaire. The 11 issues are:

- **Increasing conflicts and polarization among various user groups (recreationists, hunters, loggers, etc.) over uses of the National Forests.** Demand is increasing for almost all uses of the National Forests. The public has an increasing interest in, and places an increasing value on, the noncommodity uses of National Forests. This implies a reduced role for the more traditional commodity outputs from National Forests. More land is being set aside for special uses, which reduces the land base available for multiple use management. Timber output is expected to decline. Special interest groups are increasingly less willing to compromise, and are becoming polarized in their viewpoints on National Forest policies. These trends pose mounting problems for National Forest management.

- **Increasing conflicts between local and national interests and priorities.** Conflicts are increasing between national and local interests and priorities, with local interests often stressing environmental and noncommodity use concerns. There is a need for national accountability, which will increasingly tie the hands of field managers. Questions related to this issue include the role of State and Federal agencies in assuring community stability. Also included are concerns over ecosystem preservation, management of old growth areas, threatened and endangered species, etc. There is also continued conflict about decentralization vs. centralization of authority within the Forest Service. This conflict revolves around the question of how much decisionmaking authority and responsibility should be delegated to the field. Also included here are conflicts over decisions made at different levels within the Forest Service, which may be due to a lack of adequate criteria and clear rules.

- **Increasing adverse impacts on the National Forests due to certain uses, including illegal ones (e.g., off-road vehicles, marijuana growing, etc.).** To what extent and how should National Forest uses be controlled to reduce the decline in output quality? For example, the growing use of off-road vehicles of all kinds is adversely impacting forests and related resources. The quality of recreation experiences is declining because of increased use. In some areas of the country, illegal use of National Forests for marijuana growing and drug smuggling presents difficult law enforcement problems. To what extent is improved law enforcement needed to protect public safety?

- **Increasing problems associated with the wildland/residential/urban interface.** With growing numbers of rural residences being built in wildland areas near expanding urban areas, National Forest and other wildland managers face the challenge of managing and protecting forest resources while ensuring the safety of adjacent residents and businesses. This issue also includes the problem of private landowners adjacent to National Forests who block public access to National Forests by preventing the construction of new access roads.

- **Increasing role of the National Forests in watershed and water management.** The demand for water is growing faster than the supply. In several parts of the country water will become the major concern of National Forest managers. Increasing uses of the National Forests are causing a decline in water quality. The growing concern for the improved management of riparian environments is likely to lead to increasing conflicts with range and cattle management. As demands for water use increase, western water rights will become an increasing source of conflict.

- **User fees becoming commensurate with costs (below cost timber sales, recreation, etc.).** To what extent should the costs of providing each good and service from the National Forests be recovered by user fees? What should the charges be and how should they be levied against the various uses? With declining budgets, pressure is increasing for a pay-as-you-go approach to many forest uses, particularly recreation. There is concern about the equity of fees and the potential exclusion of low-income publics from some uses if higher fees are imposed. Also included in this issue is the topic of below-cost timber sales.

- **Declining resources to manage the National Forests.** In recent years, budgets and the number of personnel have been declining on the National Forests despite increasing demands for improved management, environmental protection, and all outputs or uses. How can the National Forests be managed effectively and efficiently in the face of these trends? There is growing concern about the lack of funds to maintain public investments. Declining budgets have led to a decline in entry-level personnel, which is distorting the age-class structure of Forest Service personnel.

- **Effectiveness and cost of the forest planning process.** Concern is growing over the cost of the current forest planning process. There is a need to (1) simplify the planning process and make it more responsive to user concerns through increased public involvement, (2) improve the linkage between the planning and budgeting process, and (3) increase understanding among planners of the sophisticated planning tools and techniques they are using.

- **Inconsistencies between priorities established in the planning process and those established in the budgeting/appropriations processes.** The budget and appropriation process sets different priorities from those set in the planning process. Appropriations are often well below planned activities, and may not be in line with approved plan priorities. The Forest Service lacks decisionmaking rules and processes for implementing plans in which appropriations are not in line with approved plan priorities. Improved methods are needed for incorporating public input. Polarized user groups who are not satisfied with funded activities are likely to oppose plan implementation. Plan implementation must be monitored in relation to budget decisions.

- **Increased use of legal and political processes to challenge decisions and forest plans.** Resource professionals lack credibility with the public, and resource professionals question the public's ability to make informed, sound, and balanced decisions. There is a growing lack of acceptance of agency decisions and an increasing use of appeal processes, litigation, and political processes to change agency policies and procedures.

- **Increasing constraints on planning and management activities due to environmental/conservation concerns expressed in laws or regulations (e.g., threatened and endangered species, herbicides).** Expanding environmental concerns are placing increasing constraints on management and planning activities. Alternatives are needed for chemical pesticides and herbicides. Threatened and endangered species must be provided for, and valuable wildlife habitats must be sustained. Intensifying concern over smoke management requires alternatives to burning for slash disposal. There is increased concern about the

potential long-term cumulative effects of management activities on the environment. Disposal sites for solid toxic wastes could become an important issue. Concern is growing for maintaining or improving the long term soil/site productivity and assuring sustainable development of National Forest land. Forestry is long term, but public perception is short term.

Importance of Each Issue

The second questionnaire was developed to achieve consensus on the issues and to determine their relative importance. We wanted to be sure the values assigned to indicate the relative importance of issues were independent of the ordering of the issues on the questionnaire. To test if ordering affected the ratings, we prepared the "A" questionnaires with one ordering and the "B" questionnaires with issues in the reverse order. This also means that the reference issue on the "A" questionnaires became the last issue on the "B" questionnaires and vice-versa. After normalizing the values from responses to the second questionnaire, we compared the means of the values for each issue from the two questionnaires. There were no significant differences in mean values, and we concluded that the ordering did not influence values assigned. This enabled us to combine the responses from the two different questionnaires and treat them as one group.

The rankings, range in values, mean values, and standard deviations for the 11 issues are shown in table 3. Because all values were normalized around the value assigned to

Table 3.—*Range, mean values, and standard deviations for the 11 issues*

Rank	Issue	Range	Mean	Standard deviation
1	Legal and political challenges to decisions	19-186	102	31
2	Conflicts among user groups	0	100	0
3	Conflicts between local and national interests	25-200	97	28
4	Inconsistencies between priorities established in planning and budgeting processes	19-200	93	34
5	Constraints imposed by laws or regulations	25-178	92	28
6	Declining resources	13-175	91	35
7	Forest planning process	8-188	84	35
8	User fees commensurate with costs	0-185	82	33
9	Watershed and water management	6-150	78	33
10	Wildland/residential/urban interface	0-154	74	32
11	Adverse impacts due to certain uses	5-161	72	27

"conflicts among user groups," there is no standard deviation or range for that issue. If ranked by mean, the issue "legal and political challenges to decisions" ranked highest, followed closely by "conflicts among user groups" and "conflicts between local and national interests." The least important issue was "adverse impacts due to certain uses," with "wildland/residential/urban interface" and "watershed and water management" also ranking low.

Two points stand out with regard to the rankings. First, the means do not vary widely; the mean value for the lowest ranked issue is within one standard deviation of the highest ranked issue. Because the issues were developed from participant responses to the first questionnaire, it is not surprising that all 11 issues were considered important relative to the reference issue. If issues had been provided by someone other than the respondents, there probably would have been more variation. As it is, the respondents identified the important issues and, when given an opportunity, ranked them all as relatively important.

Second, the range in values (after being normalized) for each issue is large, with standard deviations near 30 for all issues. This indicates the differences in opinions about the relative importance of any one issue, even though the average or mean opinions were fairly close. As we shall see, the wide ranges in views are, in some cases, due to differences between respondent groups.

The ranking of issues would change slightly if we use the percentage of respondents ranking an issue as the most important or percentage of respondents ranking an issue as the least important as the ranking criterion (fig. 2). The issues "inconsistencies in priorities established during the planning and budgeting processes" and "declining resources" would rank higher if this criterion were used rather than mean score. On the other end, "constraints imposed by laws or regulations" would move up greatly in ranking if we used the percentage of respondents ranking an issue the least important as the criterion—this issue had the lowest "least important" rating of any issue except for our reference issue.

Differences in Ranking Among Respondent Groups. Respondent groups discussed below include Forest Supervisors, District Rangers, and researchers (Forest Service and academic researchers combined for most of the discussion). We combined the two researcher groups so we would have the necessary number of responses for statistical testing.

Although the response rate for Regional Foresters was the highest of any respondent group (more than 55 percent) we do not discuss their responses as a respondent group because they are so few in number. The small number meant we could not guarantee anonymity to respondents. We do not discuss responses from National Forest users for the same reason. Also, neither group had the minimum number of responses necessary for testing differences between respondent groups. And, unlike our researcher respondents, it made no sense to combine the responses into one respondent group.

There was remarkable agreement among the three respondent groups on the importance of the 11 issues, particularly with regards to the three most important and three least important issues (table 4). District Rangers and Forest Supervisors thought that "legal and political challenges to decisions and forest plans" was the number one issue, probably reflecting their

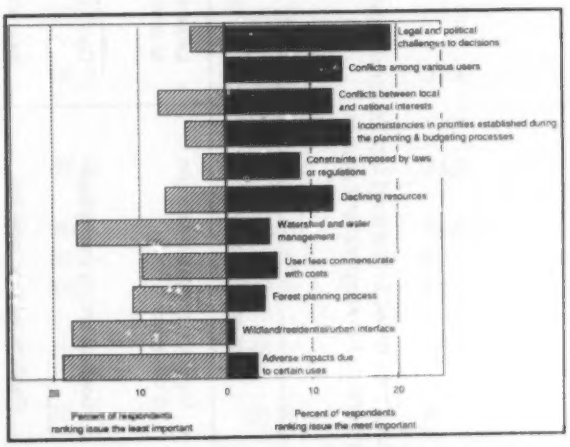

Legal and political challenges to decisions
Conflicts among various users
Conflicts between local and national interests
Inconsistencies in priorities established during the planning & budgeting processes
Constraints imposed by laws or regulations
Declining resources
Watershed and water management
User fees commensurate with costs
Forest planning process
Wildland/residential/urban interface
Adverse impacts due to certain uses
10
0
10
20
Percent of respondents ranking issue the least important
Percent of respondents ranking issue the most important

Figure 2.–*Percent of respondents ranking the issue as least important and percent of respondents ranking the issue as most important.*

Table 4.–*The three most important issues and three least important issues (using mean score as the ranking criterion) by respondent group*

	Forest Supervisors	District Rangers	Forest Service Economics Researchers	Academic Forest Economics Researchers
Three highest ranked issues	• Legal and political challenges to decisions • Conflicts among user groups • Conflicts between local and national interests	• Legal and political challenges to decisions • Conflicts among user groups • Inconsistencies in priorities established during the planning and budgeting processes	• Conflicts between local and national interests • Conflicts among user groups • Legal and political challenges to decisions	• Declining resources • Conflicts among user groups • Constraints imposed by laws or regulations
Three lowest ranked issues	• Wildland/residential/urban interface • Watershed and water management • Adverse impacts due to certain uses	• Watershed and water management • User fees commensurate with costs • Wildland/residential/urban interface	• Wildland/residential/urban interface • Watershed and water management • Adverse impacts due to certain uses	• Watershed and water management • Wildland/residential/urban interface • Adverse impacts due to certain uses

increasing frustration at having their management flexibility reduced.. Forest Service economics researchers did not feel as strongly about this issue, ranking it third behind "conflicts between local and national interests" and "conflicts among user groups." University forest economics researchers were even less concerned with "legal and political challenges to decisions," ranking it in seventh place. They thought that "declining resources" was the most important issue in managing the National Forests. Those most affected by declining resources—Forest Service District Rangers and Forest Supervisors—were much less concerned with the issue as a constraint to management and use, ranking it fifth (table 5).

Although the mean values for the issues were similar for all respondent groups, differences are more apparent if we look at the percentage of respondents rating an issue as most important or least important. Forest Supervisors and District Rangers rated "legal and political challenges to decisions" as most important more often than any other issue—23 percent of the Forest Supervisors and 27 percent of the District Rangers rated the issue as most important (fig. 3). In contrast, only 10 percent of the researchers (Forest Service and academics combined) thought "legal and political challenges to decisions" was the most important issue. Researchers were more likely to rate "conflicts among user groups," "user fees commensurate with costs," "conflicts between local and national interests," or "constraints due to laws or regulations" as most important. Three issues—"wildland/residential/urban interface," "adverse impacts due to certain uses," and "watershed and water management"—were researchers most likely candidates for least important issue.

If we look at the number of times any one issue was given the highest rating by a respondent group, we find a significant difference between ratings given by Forest Service managers

Table 5.—*Mean score by issue and respondent group*

Issues	Respondent group			
	Forest Supervisor	District Ranger	Researchers	All respondents
• Legal and political challenges to decisions	104.1	111.3	93.3	103.1
• Conflicts among user groups	100.0	100.0	100.0	100.0
• Conflicts between local and national interests	95.3	98.2	99.3	97.6
• Inconsistencies in priorities established during the planning and budgeting processes	87.9	98.6	93.1	94.3
• Constraints imposed by laws or regulations	90.3	90.8	95.0	92.9
• Declining resources	87.6	92.2	94.6	91.5
• Forest planning process	77.2	83.7	89.6	84.6
• User fees commensurate with costs	77.3	75.3	92.8	82.4
• Watershed and water management	71.7	76.8	81.8	77.1
• Wildland/residential/urban interface	74.8	75.0	78.1	74.6
• Adverse impacts due to certain uses	69.5	81.1	70.3	73.0

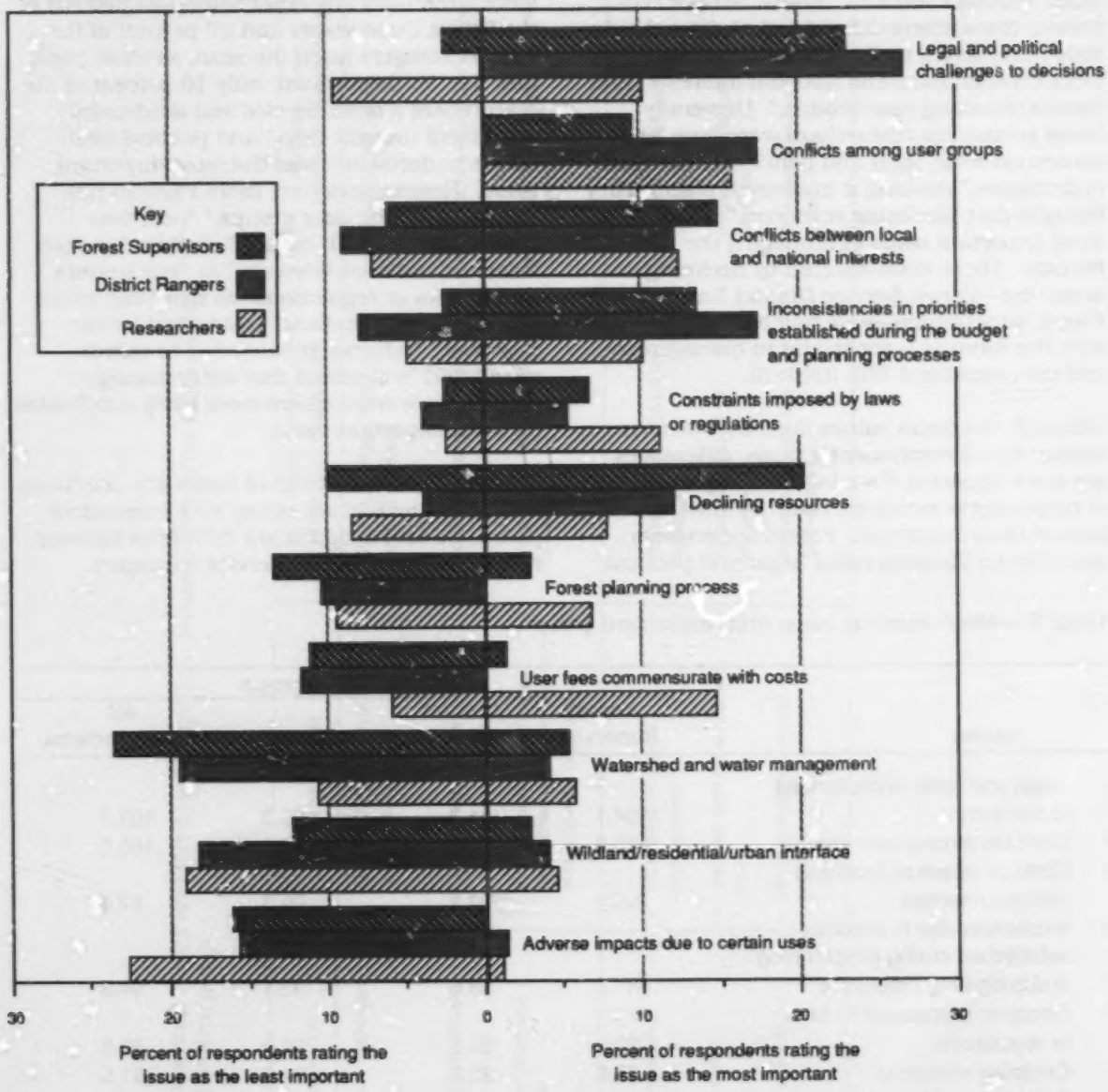


Figure 3.–*Percent of respondents ranking the issue as least important and percent of respondents ranking the issue as most important by respondent group.*

(Forest Supervisors and District Rangers) and researchers (Forest Service economics researchers and academic forest economics researchers)[2] (fig. 3). The main contributors to the difference were the issues "user fees commensurate with costs" and "legal and political challenges to decisions." "Declining resources" and "inconsistencies in priorities established during the planning and budgeting processes" also showed differences. In other words, researchers thought that "user fees commensurate with costs" was much more important than forest managers did (as indicated in figure 3), and forest managers thought that "legal and political challenges to decisions" was much more important than researchers did.

Differences in Rankings by Length of Time in Profession or Length of Time in Current Position: We were interested in whether differences in the ranking given issues could be attributed to the number of years spent in the profession or length of time in their current position. For example, we hypothesized that Forest Service managers new to their profession or their position would be more likely to disagree with the ranking given issues by their peers or their superiors (i.e. Forest Supervisors) than those who had had more time to absorb the organization's values. There were no significant differences in the responses given by participants in relation to the number of years they had been in forestry or had held their current positions.

Differences in Rankings by Geographic Region: The importance assigned the 11 issues confronting National Forest management and use was similar throughout the country. Although there were no significant differences in the importance of issues by geographic regions, we can make some general observations. Respondents from the North gave somewhat higher weight to "declining resources" and "increasing conflicts between national and local interests" than participants from other regions of the country. In the West, "legal and political challenges to decisions" was a more important issue than in other regions.

[2] *Differences in respondent group were tested using a Chi square test. The Chi square tests whether responses of the two groups are significantly different from that expected if the two groups were from one population. In this case, the responses were significantly different at P=0.003.*

Barriers to Resolving the Issue

Respondents rated the four barriers to resolving an issue on a 4-point scale, with 0 representing no importance, 1 slightly important, 2 moderately important, 3 very important, and 4 critical. Overall, for all issues and respondents, inadequate institutional support was considered to be the most important barrier to resolving emerging issues (mean score = 2.70) (fig. 4). Inadequate knowledge was considered to be the least important barrier (mean score = 1.96). The two remaining barriers, inadequate resources and inadequate incentives, had mean scores of 2.20.

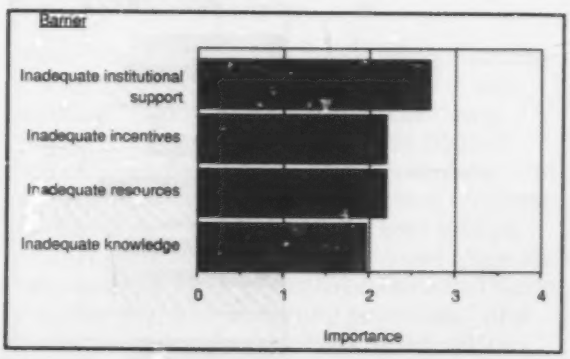


Figure 4.–*Overall importance of the four barriers to solving issues in National Forest management and use. (Importance was rated on the following scale: 0 = not important, 1 = slightly important, 2 = moderately important, 3 = very important, and 4 = critical.)*

Barrier Rankings Among Issues

There was a wide range in the importance given to the barriers for each issue (figs. 5). The lowest mean importance score was given to inadequate knowledge in solving issues related to declining resources—respondents did not see the need for more information to overcome the effects of declining resources on the management and use of National Forests. The highest

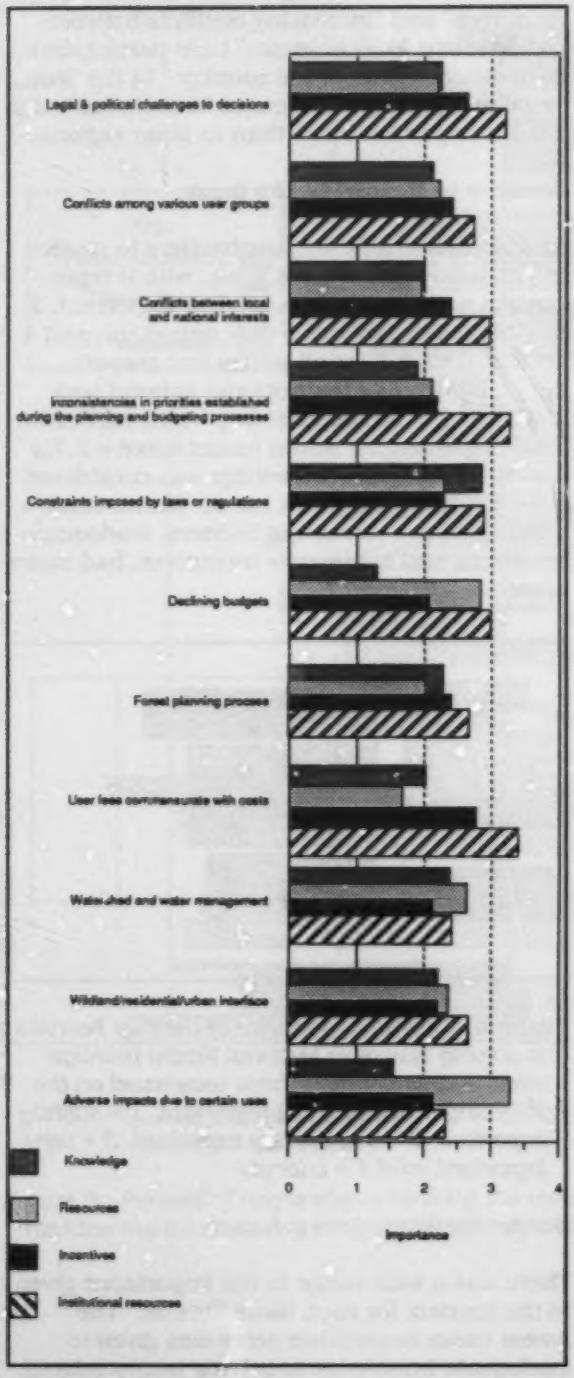


Figure 5.–*Importance of inadequate knowledge, resources, incentives, and institutional support in resolving issues related to National Forest management and use.*

mean score was given to inadequate institutional support for establishing user fees commensurate with costs—our respondents did not feel that existing laws and regulations or the organization of the Forest Service was adequate to support the establishment of user fees commensurate with costs of providing a service.

Issues hindered most by inadequate knowledge included "constraints imposed by laws or regulations," "watershed and water management," "forest planning," "legal and political challenges to decisions," and "wildland/residential/urban interface." "Adverse impacts due to certain uses" was the issue most affected by inadequate resources. Inadequate incentives was an important barrier to the issues "user fees commensurate with costs," "legal and political challenges to decisions," "forest planning," and "conflicts among user groups." Inadequate institutional support was seen as affecting "user fees commensurate with costs," "inconsistencies in priorities established during the planning and budgeting processes," and "legal and political challenges to decisions" more than other issues.

Barrier Ranking Among Respondent Groups

Respondent groups generally agreed on the importance of barriers to resolving the 11 issues for National Forest management and use (fig. 6), but disagreed on the importance of a barrier for a specific issue. As might be expected, researchers attached greater importance to "inadequate knowledge" than National Forest managers did, while National Forest managers saw a lack of resources as more important than researchers did.

Although there was general agreement on the importance of barriers when importance is measured as the mean score given by any respondent group, there was also considerable diversity of opinion within each group for most of the barriers and issues. We can see this if we look at the percent of respondents rating a barrier as most important and the percent rating a barrier as not important in resolving any specific issue (Appendix B). Consider, for example, the importance of inadequate incentives for resolving "inconsistencies in priorities

established during the planning and budgeting processes" (fig. 10, Appendix B). While 16 percent of the Forest Supervisors said that inadequate incentives were critical to resolving this issue, another 16 percent said this barrier was of no importance.

DISCUSSION

What follows are some general conclusions and suggestions for follow-up to this study.

First, we developed a method for researchers and clients to identify emerging issues in National Forest management and use, the relative importance of the issues, and barriers to resolving the issues. Once issues and barriers have been identified, it becomes the task of policy and decision makers to develop action plans for addressing issues. Where research is called for, researchers and research managers must develop research projects that offer the greatest potential for resolving the issues. The development of research studies to solve a specific problem generally cannot be aided by group interaction or consensus building. It has been shown elsewhere that researchers themselves are the major players in developing specific research projects within some broad issue areas set by funding agencies or planning mechanisms (Jakes 1988). Top-down assignment of specific research topics to good researchers is seldom productive or effective. What we have done here is identify some broad issue areas.

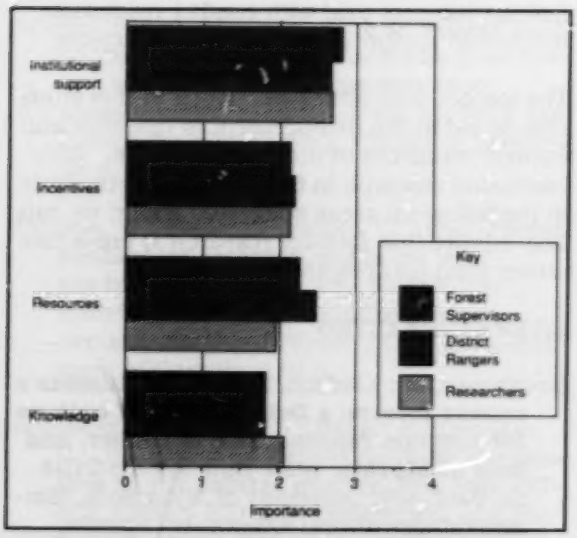


Figure 6.–*Importance of four barriers as rated by respondent groups. (Importance was rated on the following scale: 0 = not important, 1 = slightly important, 2 = moderately important, 3 = very important, and 4 = critical).*

Second, although the broad, aggregate analysis presented here is useful for identifying national issues, the diversity in response from regions and individuals should not be lost. Local priorities were different from national priorities in several instances. If this method is used to develop research priorities for a particular region, research station, or research program, all potential clients and researchers should be included so that sources for issues are not inadvertently excluded.

Third, the agreement of Forest Service managers on the importance of the 11 issues was striking. Eighty-one percent of the Forest Supervisors and 86 percent of the District Rangers responding gave the top ranking to the same five issues: "legal and political challenges to decisions," "conflicts among user groups," "conflicts between local and national interests," "inconsistencies in priorities established during the planning and budgeting processes," and "constraints imposed by laws or regulations." There was also close agreement on the importance of the four barriers in resolving issues, with institutional barriers ranked as most important.

Fourth, we have demonstrated that researchers and National Forest managers do not always agree on the importance of issues related to the management and use of National Forests, or on the potential barriers to resolving the issues. Undoubtedly, similar differences in perceptions exist between forestry researchers and other clients. The question is, are differences in perceptions important? They are if they hinder research programs to solve important resource problems. If researchers and clients do not agree on research problems, then the research

program will not be viewed as effective. We see a continued need for dialogue between researchers and their clients, particularly when defining research problems.

Finally, for many of the 11 issues, the research relevant to the issue is social science research—specifically social, behavioral, and managerial sciences. Seldom do you see social science research identified as a priority for forestry research. The traditional response to requests for research needs focuses on technical questions, such as growth and yield data, wildlife habitat requirements, and recreation user information. Research in these fields is essential to maintaining the resource base and improving production efficiency. The need for more and better technical information would have undoubtably been expressed by another group of natural resource professionals. However, our respondents have indicated that this technical information does little to resolve day-to-day issues they face as resource managers. The responses by our National Forest managers indicate how their jobs have changed since the days of Gifford Pinchot. The 11 issues reflect the realities faced by today's forest manager—they relate, almost exclusively, to people problems, not technical problems. In the first questionnaire we asked respondents to suggest any issue they felt was emerging as important—we did not exclude technical issues. In reading the responses to the first questionnaire, we sensed that we are much further ahead in terms of our technical knowledge than we are in terms of our knowledge of how to manage people and organizations. Analysis of our responses indicates a need for expanded research in fields such as law, sociology, political science, economics, and management sciences, or more development and application of research already done in those fields to forestry.

From these findings, we suggest five follow-up activities:

- Expand this present effort to bring in researchers from disciplines other than economics, and explore means for bringing National Forest users more effectively into the process.
- Explore alternative means of establishing dialogue between researchers and resource managers so management issues and research strategies can be discussed more systematically, and with differences of opinions can be recognized and discussed.
- Bring together forest economists and other social and behavioral science researchers to identify strategies for addressing the 11 issues identified here.
- Apply the approach developed here at the Forest Service Research Work Unit level, using a Delphi exercise to develop problems for the Research Work Unit Description.
- Explore possibilities for establishing a natural resources research program in conflict management.

Regarding the final recommendation, there is a significant body of scientific literature related to conflict management in other fields (see references cited in Marcouiller and Ellefson 1987). Given that 4 out of 5 of the most important issues identified by Forest Supervisors and District Rangers deal with conflict resolution, this would appear a relevant area to explore.

The method and issues developed in this study should aid in the management of research and natural resources in the Forest Service. With continued research in these areas, particularly in the follow-up areas suggested above, we can help ensure that forestry research is pro-active rather than just reactive.

LITERATURE CITED

Baughman, M.; Ellefson, P. 1983. **Minnesota's county forests: a Delphi study of options for program funding, sale of timber, and land ownership**. State Bull. AD-SB-2194. St. Paul, MN: University of Minnesota, Minnesota Agricultural Experiment Station, 44 p.

Chapman, R.; Milliken, G. 1988. **Forest Service research: dealing with the issues underlying concerns of competitiveness and system responsiveness.** Consultants

report to the Forest Service. Littleton, CO: Milliken Chapman Research Group, Inc. 28 p. plus appendices.

Gunderman, E. 1978. **Die beurteilung der umwelteinwirkungen von forststrassen im Hochgebirge: eine delphi-studie.** Forschungsberichte 41, Forstliche Forschungsanstalt, Munich, Federal Republic of Germany. 298 p.

Helmer, O. 1967. **Analysis of the future: the Delphi method.** In: Bright, James, ed. Technological forecasting for industry and government. Englewood Cliffs, NJ: Prentice Hall: 116-133.

Jakes, P. 1988. **Research evaluation in the U.S. Forest Service: opinions of research managers**. Research Policy. (17): 283-292.

Linstone, H.A.; Turoff, M. 1975. **Introduction**. In: Linstone, H.A.; Turoff, M., eds. The Delphi method: techniques and applications. Reading MA: Addison-Wesley Publishing Co: 1-10.

Marcouiller, D.; Ellefson, P. 1987. **Forest land use and management conflicts: a review and evaluation of approaches for management.** Staff Paper 65. St. Paul, MN: University of Minnesota, College of Forestry, 86 p.

Phillips, W.; Beck, J.; Lamble, G. 1986. **Forest economics research needs for west-central Canada**. Inf. Rep. NOR-X-281. Edmonton, Alberta: Canadian Forestry Service, Northern Forestry Centre, Government of Canada, 110 p.

Schuster, E.; Frissell, S.; Baker, E.; Loveless, R., Jr. 1985. **The Delphi method: application to elk habitat quality**. Res. Pap. INT-353. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 32 p.

Shafer, E.; Moeller, G.; Getty, R. 1974. **Future leisure environments.** Res. Pap. NE-301. Upper Darby, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 16 p.

Weatherman, R.; Swenson, K. 1974. **Delphi technique**. In: Hencley, S.; Yates, J., eds. Futurism in education: methodologies. Berkley,CA: McCutchan Publishing Co: 97-114.

APPENDIX A—ADDITIONAL ISSUES OFFERED ON THE SECOND QUESTIONNAIRE BY RESPONDENT GROUP

Forest Service Manager (Forest Supervisor or District Ranger)

- Conflict between traditional goods and services produced on National Forest land and new thinking on long-term productivity.
- Current range management practices and funding.
- Public education about why we do what we do.
- Inability of the Forest Service organization (at all levels) to recognize and then manage, i.e., cope with emerging issues.
- A probable shift nationally toward import of agricultural products (to include timber) which will shift demand for National Forest resources away from traditional emphasis on timber selling and more toward other resources. Will require an adjustment in skills and attitudes within the agency.
- Increasing use of misinformation techniques to "scare" the general public into supporting nondevelopment of resources.
- Management of energy resources on National Forest system.
- Lack of salesmanship by Forest Service to take our message and show our management to users.
- Interagency coordination (State and Federal). Increasing problems associated to wetlands. Demand for information from interest groups.
- Maintaining long-term site productivity.

- Declining morale of Forest Service employees causing decrease of quality and quantity.
- Other State and Federal agencies controlling activities on National Forest land, such as minerals, threatened and endangered species, water.
- Metropolitan America does not recognize the need for wood on public land to be used for industry production of wood products.
- Effect of affirmative action directions on recruiting and holding a highly qualified and motivated work force.
- Decreasing amount of common sense in young people.
- Hiring, training, and retaining a highly efficient and motivated work force. Process of implementing forest plans. Use of prescribe fire to obtain resource objectives. Coordination with State and Federal agencies responsible for single (or limited) resources vs. the multiple resource agencies like the Forest Service.
- The inability and reluctance to get decisions implemented.
- The role of the National Forests in the nation. (Define the goods and services they are to provide in the future.) (How much wood should come from public lands?) Clearcutting and/or the silvicultural methods used to harvest timber.

Researcher (Forest Service and Academic)

- I still feel strongly about the problem of establishing constant resource values.
- Is the National RPA Assessment/Program consistent with forest-level planning?
- National Forests becoming National Parks.
- Plan alternative rationalization, i.e., can an agency "prefer" a 30 percent reduction in harvest or scale backs in species populations—or should legislative targets be set.
- Need to greatly increase staff and dollars on fish and wildlife commensurate with "Multiple Use Management." Better training of foresters—political system, administration, communications.
- Increasing problems due to negative externalities from private land management that impact National Forest system lands.
- Ability of universities to graduate foresters having adequate technical skills/ability to develop skills.
- I found it difficult to make clear distinctions between your issues, e.g., issues 9 and 11 seemed part of issue 2 and issues 1 and 3 seemed really the same. Also, my answers are biased. I put more weight on issues I knew something about. Some issues are oriented more toward National Forest administration problems, less toward broader policy issues (which I knew more about). The water issue will be more "western." I can't help but feel these employment and regional biases will show in response. I guess some cross-tabs will help show if my feeling is correct.
- Economic efficiency of management-fiscal and economic accountability. Economic as well as biological/technical efficiency (might be assumed under issue 8 but here more concern with management rather than planning).
- Inadequate identification of user needs and inadequate management of the Forest Service as an institution to meet these needs.
- Shift in commodity production from NF to private lands, especially NIPF.
- Develop technological and marketing strategies to utilize resources currently wasted or unused.
- Research efforts are declining while research needs, i.e., problems are increasing. Reduced attention to the recreation resource. Limited research on integrated resource management. Limited attention to

urban needs and concerns. Limited attention to the visual resource.

- Failure to recognize nonpriced values in planning and budgeting processes.
- Uncertainty in future demand for forest products, especially traditional sawtimber products. Potential for production enhancing technology, such as biotechnology advances in timber growth, and insect/disease control, and pulp/paper processing.

Other (National Forest User)

- Identify the economic importance of timber management to local communities.
- Decreased commitment to policy of "the greatest good to the greatest number of people."

APPENDIX B—FIGURES SHOWING THE IMPORTANCE OF BARRIERS TO RESOLVING ISSUES BY ISSUE AND RESPONDENT GROUP

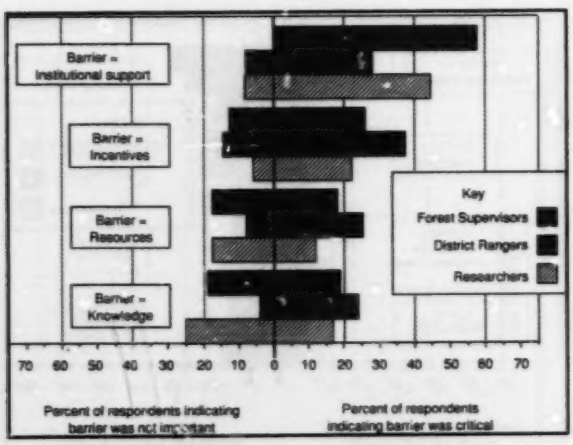

Barrier = Institutional support
Barrier = Incentives
Barrier = Resources
Barrier = Knowledge
Key
Forest Supervisors
District Rangers
Researchers
70 60 50 40 30 20 10 0 10 20 30 40 50 60 70
Percent of respondents indicating barrier was not important
Percent of respondents indicating barrier was critical

Figure 7.–*Percent of respondents indicating a barrier was not important and percent of respondents indicating a barrier was critical in resolving legal and political challenges to decisions, by respondent group.*

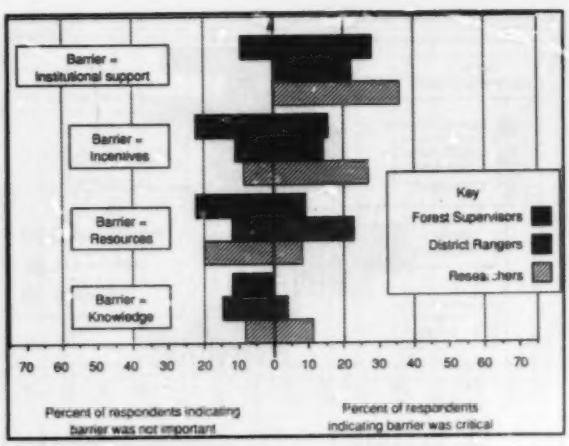

Barrier = Institutional support
Barrier = Incentives
Barrier = Resources
Barrier = Knowledge
Key
Forest Supervisors
District Rangers
Researchers
70 60 50 40 30 20 10 0 10 20 30 40 50 60 70
Percent of respondents indicating barrier was not important
Percent of respondents indicating barrier was critical

Figure 9.–*Percent of respondents indicating a barrier was not important and percent of respondents indicating a barrier was critical in resolving conflicts between local and national interests, by respondent group.*

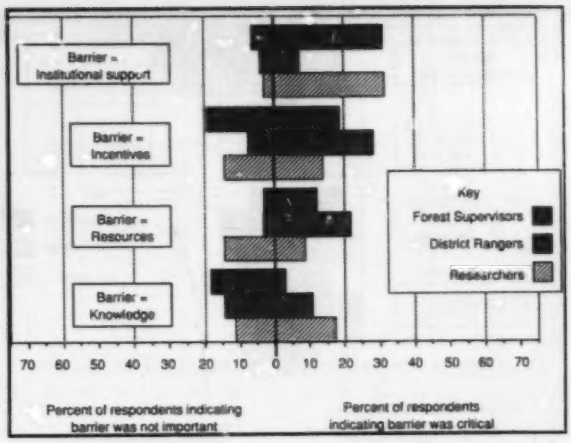

Barrier = Institutional support
Barrier = Incentives
Barrier = Resources
Barrier = Knowledge
Key
Forest Supervisors
District Rangers
Researchers
70 60 50 40 30 20 10 0 10 20 30 40 50 60 70
Percent of respondents indicating barrier was not important
Percent of respondents indicating barrier was critical

Figure 8.–*Percent of respondents indicating a barrier was not important and percent of respondents indicating a barrier was critical in resolving conflicts among various users, by respondent group.*

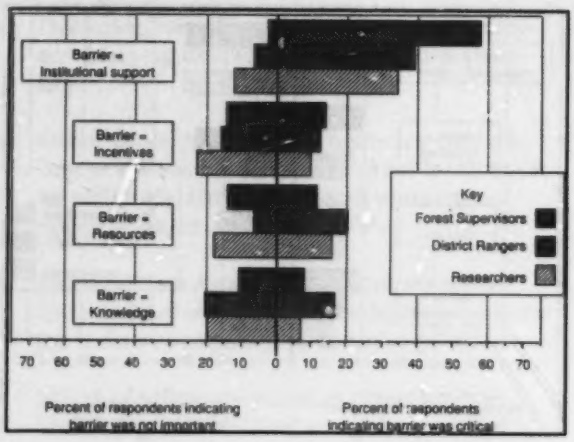

Barrier = Institutional support
Barrier = Incentives
Barrier = Resources
Barrier = Knowledge
Key
Forest Supervisors
District Rangers
Researchers
70 60 50 40 30 20 10 0 10 20 30 40 50 60 70
Percent of respondents indicating barrier was not important
Percent of respondents indicating barrier was critical

Figure 10.–*Percent of respondents indicating a barrier was not important and percent of respondents indicating a barrier was critical in resolving inconsistencies in priorities established during the planning and budgeting processes, by respondent group.*

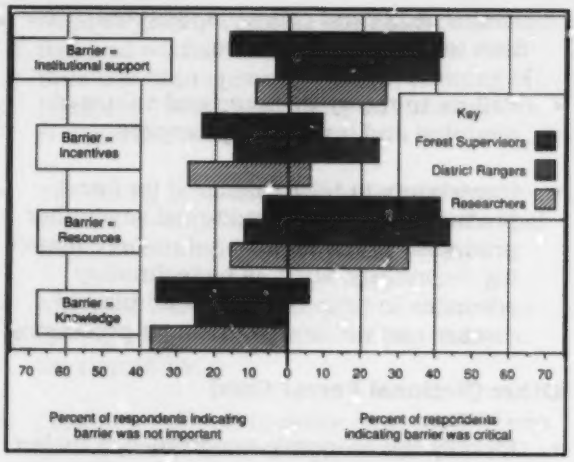

Barrier = Institutional support
Barrier = Incentives
Barrier = Resources
Barrier = Knowledge
Key
Forest Supervisors
District Rangers
Researchers
70 60 50 40 30 20 10 0 10 20 30 40 50 60 70
Percent of respondents indicating barrier was not important
Percent of respondents indicating barrier was critical

Figure 12.–*Percent of respondents indicating a barrier was not important and percent of respondents indicating a barrier was critical in resolving declining budgets, by respondent group.*

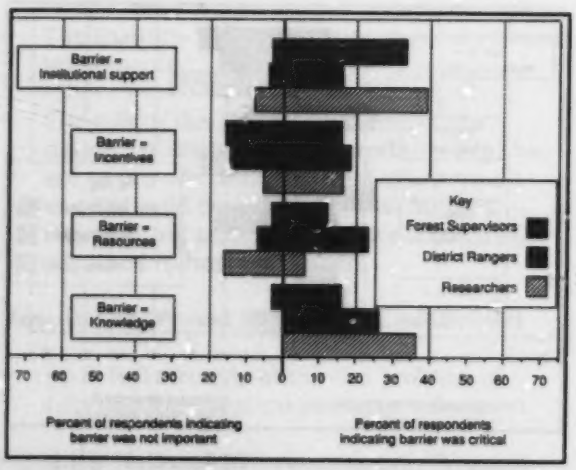

Barrier = Institutional support
Barrier = Incentives
Barrier = Resources
Barrier = Knowledge
Key
Forest Supervisors
District Rangers
Researchers
70 60 50 40 30 20 10 0 10 20 30 40 50 60 70
Percent of respondents indicating barrier was not important
Percent of respondents indicating barrier was critical

Figure 11.–*Percent of respondents indicating a barrier was not important and percent of respondents indicating a barrier was critical in resolving constraints imposed by laws or regulations, by respondent group.*

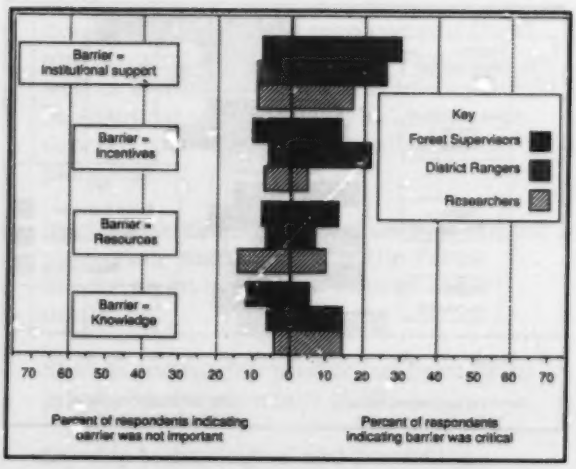

Barrier = Institutional support
Barrier = Incentives
Barrier = Resources
Barrier = Knowledge
Key
Forest Supervisors
District Rangers
Researchers
70 60 50 40 30 20 10 0 10 20 30 40 50 60 70
Percent of respondents indicating barrier was not important
Percent of respondents indicating barrier was critical

Figure 13.–*Percent of respondents indicating a barrier was not important and percent of respondents indicating a barrier was critical in resolving the forest planning process, by respondent group.*

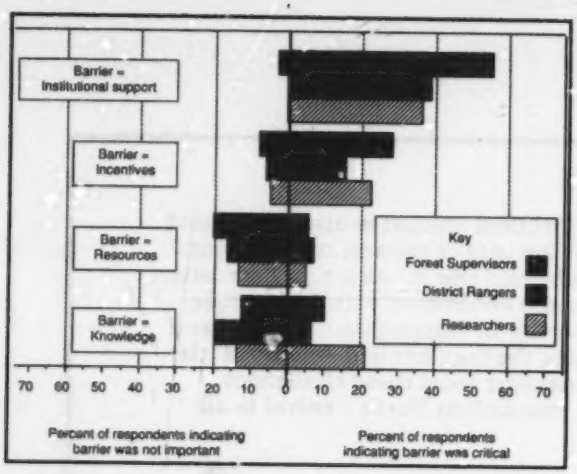

Barrier = Institutional support
Barrier = Incentives
Barrier = Resources
Barrier = Knowledge
Key
Forest Supervisors
District Rangers
Researchers
70 60 50 40 30 20 10 0 10 20 30 40 50 60 70
Percent of respondents indicating barrier was not important
Percent of respondents indicating barrier was critical

Figure 14.–*Percent of respondents indicating a barrier was not important and percent of respondents indicating a barrier was critical in resolving user fees commensurate with costs, by respondent group.*

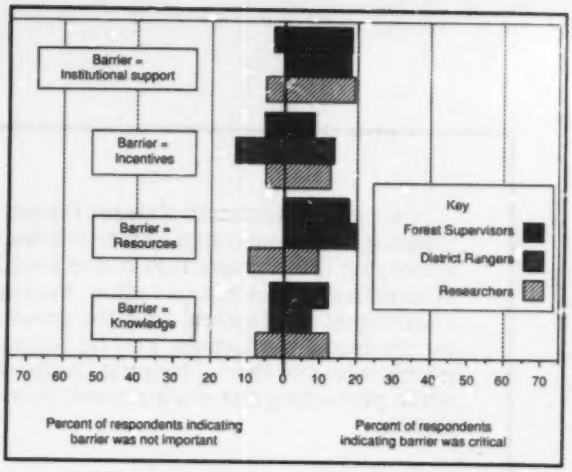

Barrier = Institutional support
Barrier = Incentives
Barrier = Resources
Barrier = Knowledge
Key
Forest Supervisors
District Rangers
Researchers
70 60 50 40 30 20 10 0 10 20 30 40 50 60 70
Percent of respondents indicating barrier was not important
Percent of respondents indicating barrier was critical

Figure 16.–*Percent of respondents indicating a barrier was not important and percent of respondents indicating a barrier was critical in resolving management questions related to the wildland/residential/urban interface, by respondent group.*

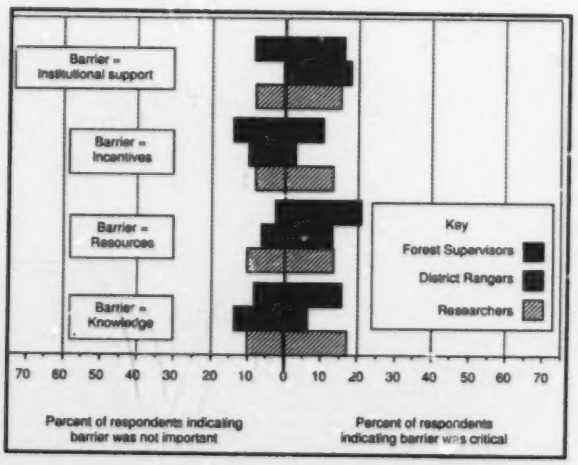

Barrier = Institutional support
Barrier = Incentives
Barrier = Resources
Barrier = Knowledge
Key
Forest Supervisors
District Rangers
Researchers
70 60 50 40 30 20 10 0 10 20 30 40 50 60 70
Percent of respondents indicating barrier was not important
Percent of respondents indicating barrier was critical

Figure 15.–*Percent of respondents indicating a barrier was not important and percent of respondents indicating a barrier was critical in resolving questions related to water and watershed management, by respondent group.*

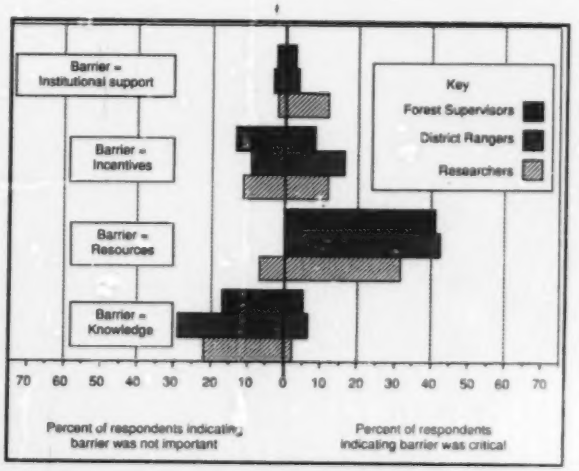

Barrier = Institutional support
Barrier = Incentives
Barrier = Resources
Barrier = Knowledge
Key
Forest Supervisors
District Rangers
Researchers
70 60 50 40 30 20 10 0 10 20 30 40 50 60 70
Percent of respondents indicating barrier was not important
Percent of respondents indicating barrier was critical

Figure 17.–*Percent of respondents indicating a barrier was not important and percent of respondents indicating a barrier was critical in resolving adverse impacts due to certain uses, by respondent group.*

☆ U.S. Government Printing Office: 1989 — 755-412/99

Our job at the North Central Forest Experiment Station is discovering and creating new knowledge and technology in the field of natural resources and conveying this information to the people who can use it. As a new generation of forests emerges in our region, managers are confronted with two unique challenges: (1) Dealing with the great diversity in composition, quality, and ownership of the forests, and (2) Reconciling the conflicting demands of the people who use them. Helping the forest manager meet these challenges while protecting the environment is what research at North Central is all about.